

The Use of Handheld X-Ray Fluorescence (XRF) Technology in Unraveling the Eruptive History of the San Francisco Volcanic Field, Arizona

K.E. Young (Kelsey.E.Young@asu.edu)¹, C.A. Evans², and K.V. Hodges¹

1. School of Earth and Space Exploration, Arizona State University, P.O. Box 871404, Tempe, AZ 85282

2. Astromaterials Acquisition and Curation Office, NASA Johnson Space Center, Houston, TX

While traditional geologic mapping includes the examination of structural relationships between rock units in the field, more advanced technology now enables us to simultaneously collect and combine analytical datasets with field observations. Information about tectonomagmatic processes can be gleaned from these combined data products. Historically, construction of multi-layered field maps that include sample data has been accomplished serially (first map and collect samples, analyze samples, combine data, and finally, readjust maps and conclusions about geologic history based on combined data sets). New instruments that can be used in the field, such as a handheld x-ray fluorescence (XRF) unit, are now available. Targeted use of such instruments enables geologists to collect preliminary geochemical data while in the field so that they can optimize scientific data return from each field traverse. Our study tests the application of this technology and projects the benefits gained by real-time geochemical data in the field. The integrated data set produces a richer geologic map and facilitates a stronger contextual picture for field geologists when collecting field observations and samples for future laboratory work. Real-time geochemical data on samples also provide valuable insight regarding sampling decisions by the field geologist.

We employ handheld x-ray fluorescence (XRF) technology, originally developed for work in industry and mining, to the understanding of and differentiation between multiple volcanic flow lobes. Using the handheld XRF, we analyzed a series of basalts and basaltic andesites collected from different flows in the San Francisco Volcanic Field in northern Arizona in conjunction with recent NASA tests of technologies for human scientific exploration of other planetary surfaces. Our objective was to determine whether this technology is able to distinguish between multiple eruptive pulses. Very little published geochemical work from this area is available. We used a geologic map compiled from detailed satellite images by the United States Geological Survey (USGS) that was produced to support the NASA analog mission. This study demonstrates the utility of having real-time geochemical information in unraveling the geologic history of a volcanic terrain derived of cinder cones and multiple, overlapping lava flows. Handheld XRF technology is useful in ensuring that all data collected in a field campaign will move toward establishing a complete tectonomagmatic view of an area.